CLAIMS

We claim:

1. Apparatus for producing an output solution having a predetermined level of available free chlorine comprising an electrolytic cell, means for passing a saline solution having a substantially constant chloride ion concentration through the cell, means for applying a substantially constant current across the cell and means for dispensing outputoutput solution solution from the cell.

2. Apparatus according to claim 1, wherein the electrolytic cell comprises anode and cathode chambers separated by a separator, each chamber having a feed line through which the saline solution is fed into the chamber and anolyte and catholyte lines respectively for receiving the electrochemically treated solution.

3. Apparatus according to claim 2, wherein the output solution comprises the anolyte.

4. Apparatus according to claim 3, further comprising a catholyte recirculation line for feeding at least a portion of catholyte from the cathode chamber to the input line of the anode chamber.

5. Apparatus according to claim 1, further comprising a concentrated salt solution make up tank, a process water tank and mixing means for mixing a concentrated salt solution from the make up tank with process water from the water tank to produce the saline solution.

6. Apparatus according to claim 5, wherein the mixing means comprises a dispenser for dispersing pulses of concentrated salt solution into a continuous flow of process water.

7. Apparatus according to claim 6, wherein the dispenser comprises a tube having a closed end, an open, feed end and a plurality of apertures along its length.

8. Apparatus according to claim 5, wherein the electrolytic cell is positioned at a level higher than the concentrated salt solution make up tank and the process water tank thereby to reduce back pressure on the cell.

9. Apparatus according to claim 1, further comprising an intermediate holding tank for receiving output solution from the cell.

10. Apparatus according to claim 9, further comprising measuring means to measure biocidal efficacy of the output solution in the intermediate holding tank.

11. Apparatus according to claim 10, wherein the measuring means comprises a pH meter and a redox probe.

12. Apparatus according to claim 9, further comprising a storage tank for receiving output solution from the intermediate holding tank.

13. Apparatus according to claim 12 wherein the intermediate holding tank comprises a weir tank located above the storage tank.

14. Apparatus according to claim 13, wherein the storage tank is positioned at a height to allow output solution to be dispensed therefrom by gravity feed.

15. Apparatus according to claim 9, further comprising a rinse water storage tank for receiving output solution from the intermediate holding tank and water.

16. Apparatus according to claims 15, wherein the rinse water storage tank is positioned at a height to allow rinse water comprising output solution diluted with water to be dispensed therefrom by gravity feed.

17. Apparatus according to claim 9, further comprising corrosion inhibitor storage and dispensing means for dosing corrosion inhibitor into the intermediate holding tank.

18. Apparatus according to claim 1, further comprising a user interface for displaying information on the performance of the apparatus and the materials inputted to and outputted from the apparatus.

19. Apparatus according to claim 18, wherein the user interface includes a display with keypad controls.

20. Apparatus according to claim 18, further comprising control means to permit adjustment of operating parameters in response to information displayed.

21. Apparatus according to claim 1, further comprising a service interface for displaying diagnostic information on the performance of the apparatus.

22. Apparatus according to claim 21, wherein the service interface includes means to permit adjustment of operating parameters.

23. Apparatus according to claim 21, wherein the service interface can be accessed remotely.

24. Apparatus according to claim 1, further including one or more failsafe mechanisms to prevent output solution from being dispensed when operating parameters cannot be adjusted to ensure that the solution has the required biocidal properties or when the output solution is older than a predetermined age.

25. A method of electrochemically treating a supply of aqueous salt solution in an electrolytic cell having an anode chamber and a cathode chamber separated by a semi-permeable membrane, the anode and cathode chambers respectively being provided with an anode and a cathode, and each chamber having input and output lines for the solution being treated, wherein:

i) aqueous salt solution is supplied to the anode and cathode chambers by way of their respective input lines, at least the cathode chamber input line being provided with a flow regulator, and output by way of their respective output lines;

ii) a substantially constant current is caused to flow between the anode and the cathode; and

iii) a proportion of the solution output from the cathode chamber is recirculated to an input line of the anode chamber by way of a recirculation line.

26. A method according to claim 25, wherein the proportion of the solution output from the cathode chamber and recirculated to the input line of the anode chamber is determined by measuring the pH of the solution output from the anode

chamber and using feedback control to maintain this pH at a substantially constant value.

27. A method according to claim 26, wherein the proportion of solution output from the cathode chamber and recirculated to the input line of the anode chamber is controlled by a pump on the recirculation line, the pump having a pump rate determined as a function of the measured pH of the solution output from the anode chamber.

28. A method according to claim 25, wherein the concentration of the aqueous salt solution is from 0.30 to 0.40% w/vol.

29. A method according to claim 26, wherein the pH of the solution output from the anode chamber is maintained at a value in the range of 6.0 to 7.0 inclusive.

30. A method according to claim 26, wherein gaseous products of electrolysis are removed from the solution output from the cathode chamber and recirculated to the input line of the anode chamber.

31. Apparatus for electrochemically treating a supply of aqueous salt solution, the apparatus including an electrolytic cell having an anode chamber and a cathode chamber separated by a separator, the anode and cathode chambers respectively being provided with an anode or a cathode, and each chamber having input and output lines for the solution to be treated; wherein:

i) the input line to the cathode chamber is provided with a flow regulator;

ii) the anode and cathode are connected to a source of substantially constant direct current; and

iii) an output line from the cathode chamber is connected to an input line of the anode chamber by way of a recirculation line.

32. An apparatus as claimed in claim 31, wherein a pH probe is provided on the output line from the anode chamber.

33. An apparatus as claimed in claim 31, wherein a pump is provided on the recirculation line.

34. An apparatus as claimed in claim 33, when dependent on claim 83, wherein the pH probe and the pump together form a feedback control mechanism for adjusting a flow rate of solution through the recirculation line so as to maintain a substantially constant pH of the solution output from the anode chamber.

35. An apparatus as claimed in claim 31, wherein a degassing unit is provided on the recirculation line.

36. A method of mixing miscible liquids comprising dispersing one liquid from a pulsed source into another liquid supplied as a continuous stream, wherein the pulsed liquid is discharged and dispersed in the continuous stream through a plurality of apertures along the flow path to produce a flow of uniformly mixed liquids.

37. A method of combining at least two liquids, wherein a first liquid is supplied as a continuous stream and a second liquid miscible with the first liquid is supplied from a dispenser into which the second liquid is pulsed and dispersed into the supply stream of the first liquid through a plurality of apertures in the dispenser thereby to produce a continuous homogeneous stream of first and second liquids.

38. An electrochemical cell comprising an anode chamber and a cathode chamber separated by a separator, the anode and cathode chambers respectively being provided with an anode and a cathode, each chamber having at least one input and output, wherein the separator is in the form of a semi-permeable membrane comprising an aluminium oxide based ceramic containing zirconium oxide and yttrium oxide.

39. An electrochemical cell according to claim 38, wherein Preferablythethe ceramic membrane comprisese up to 20% zirconium oxide and up to 2% yttrium oxide.

40. An electrochemical cell according to claim 39, wherein the ceramic membrane consists essentially of 80% aluminium oxide, 18.5% zirconium oxide and 1.5% yttrium oxide.

41. An electrochemical cell according to claim 38, wherein the porosity of the ceramic membrane is within the range of 50-70% and the pore size between 0.3-0.5 microns.

42. An electrochemical cell according to claims 38, wherein the ceramic membrane has a wall thickness of 0.3 mm - 1.0 mm.